APPENDIX A

Claim 1.   (amended once)   A compound having a formula A:

$$X = A$$

(formula A)

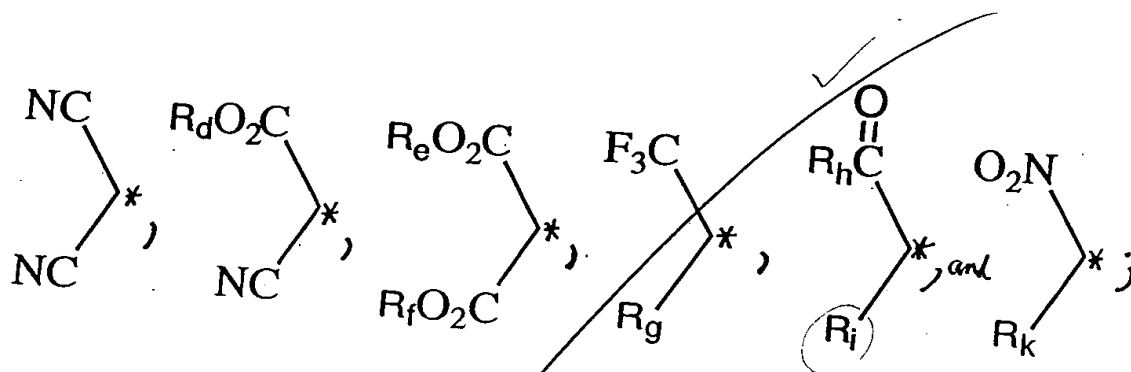wherein X is selected from the group consisting of

wherein D is selected from the group consisting of NR_aR_b, OR_a, SR_a, PR_aR_b, and R_c;

wherein A is selected from the group consisting of:

1

$$\text{NC} \diagdown \hspace{-0.3cm} \underset{\text{NC}}{\overset{}{\diagup}} \hspace{-0.2cm} *\,) \qquad \underset{\text{NC}}{\overset{R_dO_2C}{\diagup}} \hspace{-0.3cm} * \,) \qquad \underset{R_fO_2C}{\overset{R_eO_2C}{\diagup}} \hspace{-0.3cm} * \,) \qquad \underset{R_g}{\overset{F_3C}{\diagup}} \hspace{-0.3cm} * \,) \qquad \underset{(R_i)}{\overset{\overset{O}{\underset{||}{R_hC}}}{\diagup}} \hspace{-0.3cm} *\, , and \qquad \underset{R_k}{\overset{O_2N}{\diagup}} \hspace{-0.3cm} * \, ;$$
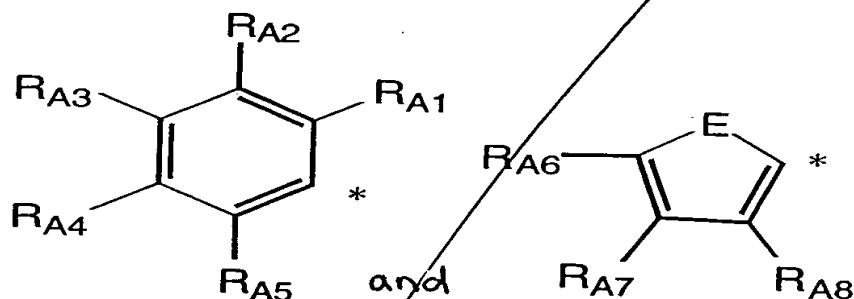
wherein R_a, R_b, and R_c are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; and an aryl group;

wherein R_d, R_e, R_f, R_l, R_m, R_n, R_o, R_p, R_q, R_r, R_s, R_t, R_u, R_v, R_w, and R_x are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic hydrocarbon group that is saturated or unsaturated; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; and an aryl group;

wherein R_g, R_h, R_i, and R_k are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic hydrocarbon group that is saturated or unsaturated; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; an aryl group; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; $-CO_2R_d$; and $-COR_d$;

wherein each aryl group is optionally independently selected from the group consisting of

wherein R_{A1}, R_{A2}, R_{A3}, R_{A4}, R_{A5}, R_{A6}, R_{A7}, and R_{A8} are the same or different and are each independently selected from the group consisting of H, a linear alkyl group, a branched alkyl group, and a cyclic alkyl group;

wherein E is selected from the group consisting of S, O, and NR_s;

wherein the alkyl group is optionally substituted or unsubstituted and optionally includes up to 25 carbon atoms;

wherein α is an integer that is greater than or equal to 0 and less than or equal to 25;
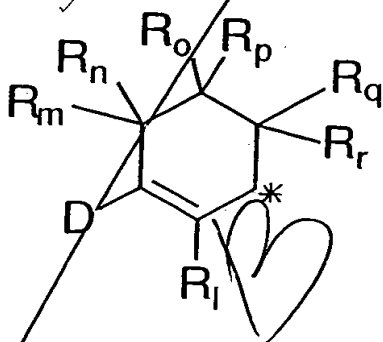
wherein β is an integer that is greater than or equal to 0 and less than or equal to 25;

wherein γ is an integer that is greater than or equal to 0 and less than or equal to 25; and

when: D is CH_3; R_m, R_n, R_q, and R_r are each H; R_o is H or CH_3;

R_p is H or CH_3; and X is

)

then A is not C(CN)(CN).

Claim 2.   (amended once)   A compound as claimed in Claim 1, wherein R_l, R_m, R_n, R_o, R_p, R_q, R_r, R_t, R_u, R_v, R_w, and R_x are each H; wherein A is C(CN)(CN); and wherein D is R_y or OR_y, and wherein R_y is selected from the group consisting of the linear alkyl group, the branched alkyl group, the cyclic alkyl group, and the aryl group.
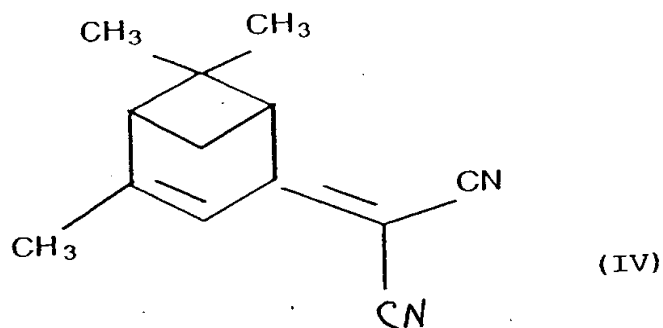
Claim 3.   (amended once)   A compound as claimed in Claim 1, wherein the compound is selected from the group consisting of
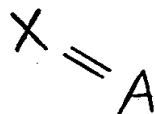
(II)

A1
cont.

and

(IV)
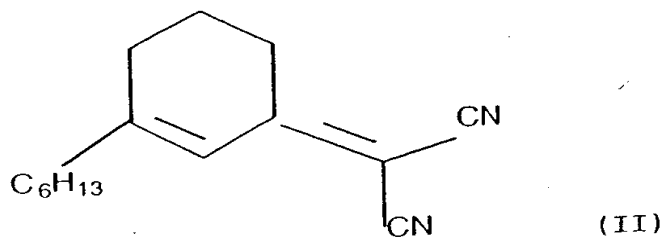
A2

Claim 7. (amended once) A liquid-crystal dopant comprising the compound claimed in Claim 1, wherein the liquid-crystal dopant has: (1) at about 20-30°C an absorption loss in a visible region of less than or equal to about 5%; (2) at about 20-30°C a dielectric anistropy of greater than about 50; and (3) at about 20-30°C a viscosity lower than about 50 centipoise.
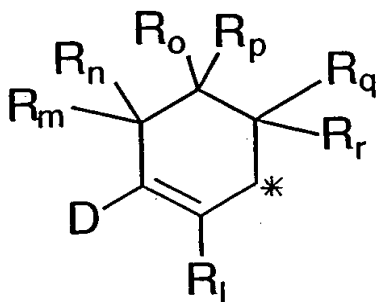
5

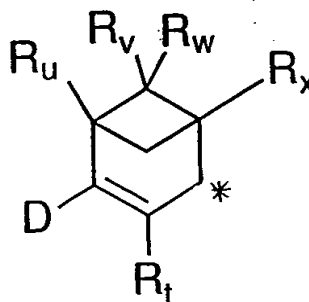Claim 9.   (amended once)   A composition comprising a liquid-crystal mixture and a compound having a formula A:

$$X = A$$ (formula A)

wherein X is selected from the group consisting of
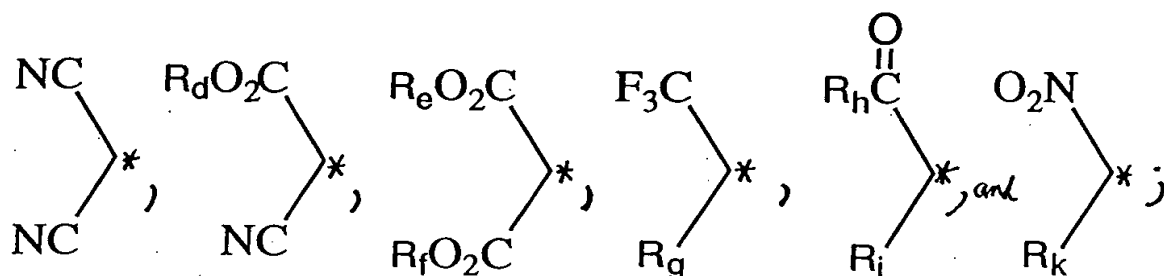
A)

and

j

wherein D is selected from the group consisting of NR_aR_b, OR_a, SR_a, PR_aR_b, and R_c;

wherein A is selected from the group consisting of:

6

$$NC \underset{NC}{\overset{}{\diagup}}\hspace{-0.3em}\big\rangle\hspace{-0.3em}*,\quad R_dO_2C \underset{NC}{\overset{}{\diagup}}\hspace{-0.3em}\big\rangle\hspace{-0.3em}*,\quad R_eO_2C \underset{R_fO_2C}{\overset{}{\diagup}}\hspace{-0.3em}\big\rangle\hspace{-0.3em}*,\quad F_3C \underset{R_g}{\overset{}{\diagup}}\hspace{-0.3em}\big\rangle\hspace{-0.3em}*,\quad R_h\overset{\overset{O}{\|}}{C} \underset{R_i}{\overset{}{\diagup}}\hspace{-0.3em}\big\rangle\hspace{-0.3em}*,\ and\quad O_2N \underset{R_K}{\overset{}{\diagup}}\hspace{-0.3em}\big\rangle\hspace{-0.3em}*;$$
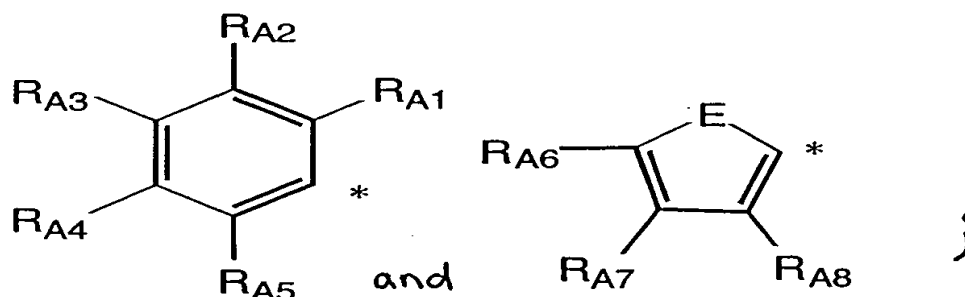
wherein R_a, R_b, and R_c are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; and an aryl group;

A_3
$cont.$

wherein R_d, R_e, R_f, R_l, R_m, R_n, R_o, R_p, R_q, R_r, R_s, R_t, R_u, R_v, R_w, and R_x are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic hydrocarbon group that is saturated or unsaturated; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; and an aryl group;

wherein R_g, R_h, R_i, and R_k are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic hydrocarbon group that is saturated or unsaturated; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; an aryl group; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; $-CO_2R_d$; and $-COR_d$;

wherein each aryl group is optionally independently selected from the group consisting of

wherein R_{A1}, R_{A2}, R_{A3}, R_{A4}, R_{A5}, R_{A6}, R_{A7}, and R_{A8} are the same or different and are each independently selected from the group consisting of H, a linear alkyl group, a branched alkyl group, and a cyclic alkyl group;

A3
cont. wherein E is selected from the group consisting of S, O, and NR_s;

wherein the alkyl group is optionally substituted or unsubstituted and optionally includes up to 25 carbon atoms;
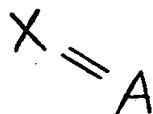
wherein α is an integer that is greater than or equal to 0 and less than or equal to 25;

wherein β is an integer that is greater than or equal to 0 and less than or equal to 25; and

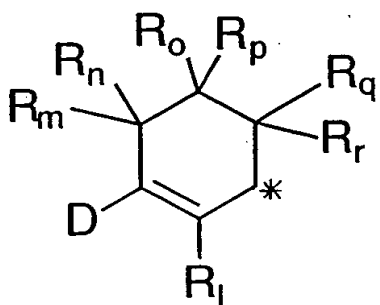wherein γ is an integer that is greater than or equal to 0 and less than or equal to 25.

Claim 11. (amended once) A method for reducing an operation voltage of a liquid-crystal mixture, the method comprising adding to the liquid-crystal mixture a compound having a formula A:
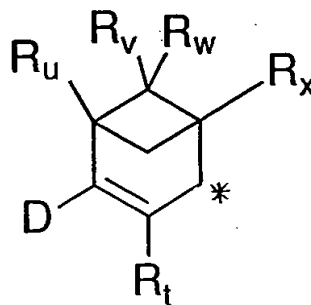
$$X = A$$

(formula A)

wherein X is selected from the group consisting of
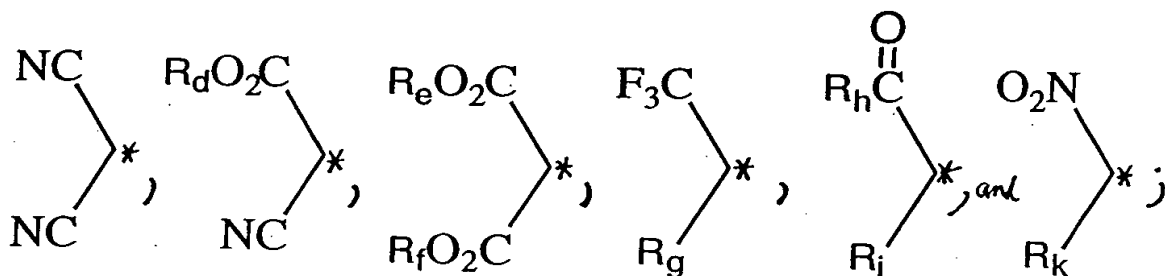

and *A4*

wherein D is selected from the group consisting of NR_aR_b, OR_a, SR_a, PR_aR_b, and R_c;

wherein A is selected from the group consisting of:

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$$NC \overset{NC}{\diagdown} \Big\rangle *, \quad R_dO_2C \overset{}{\diagdown} \underset{NC}{\Big\rangle} *, \quad R_eO_2C \overset{}{\diagdown} \underset{R_fO_2C}{\Big\rangle} *, \quad F_3C \overset{}{\diagdown} \underset{R_g}{\Big\rangle} *, \quad \overset{O}{\underset{R_i}{R_hC \Big\rangle}} *, and \quad O_2N \overset{}{\diagdown} \underset{R_k}{\Big\rangle} *;$$
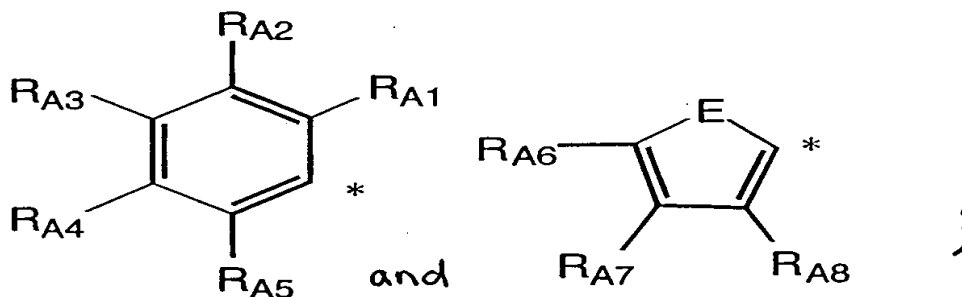
wherein R_a, R_b, and R_c are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; and an aryl group;

A4 cont -

wherein R_d, R_e, R_f, R_l, R_m, R_n, R_o, R_p, R_q, R_r, R_s, R_t, R_u, R_v, R_w, and R_x are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic hydrocarbon group that is saturated or unsaturated; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; and an aryl group;

wherein R_g, R_h, R_i, and R_k are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic hydrocarbon group that is saturated or unsaturated; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; an aryl group; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; $-CO_2R_d$; and $-COR_d$;

wherein each aryl group is optionally independently selected from the group consisting of

RA2

RA3

RA1

RA4

*

RA5   and

RA6

E

*

RA7   RA8   ;

wherein R_{A1}, R_{A2}, R_{A3}, R_{A4}, R_{A5}, R_{A6}, R_{A7}, and R_{A8} are the same or different and are each independently selected from the group consisting of H, a linear alkyl group, a branched alkyl group, and a cyclic alkyl group;

A4 cont

wherein E is selected from the group consisting of S, O, and NR_s;

wherein the alkyl group is optionally substituted or unsubstituted and optionally includes up to 25 carbon atoms;
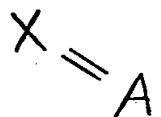
wherein α is an integer that is greater than or equal to 0 and less than or equal to 25;

wherein β is an integer that is greater than or equal to 0 and less than or equal to 25; and

wherein γ is an integer that is greater than or equal to 0 and less than or equal to 25.
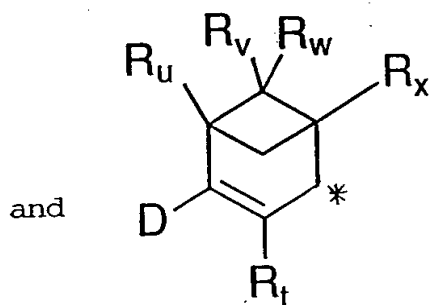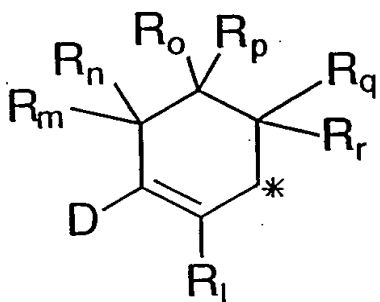
Claim 13. (amended once) A method for tuning a clearing temperature of a liquid-crystal mixture, the method comprising adding to the liquid-crystal mixture 1 a compound having a formula A:

$$X = A$$

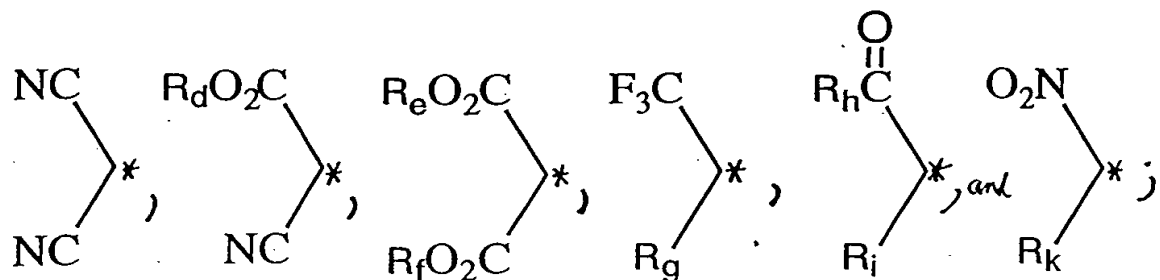(formula A)

wherein X is selected from the group consisting of

and

j

wherein D is selected from the group consisting of NR_aR_b, OR_a, SR_a, PR_aR_b, and R_c;
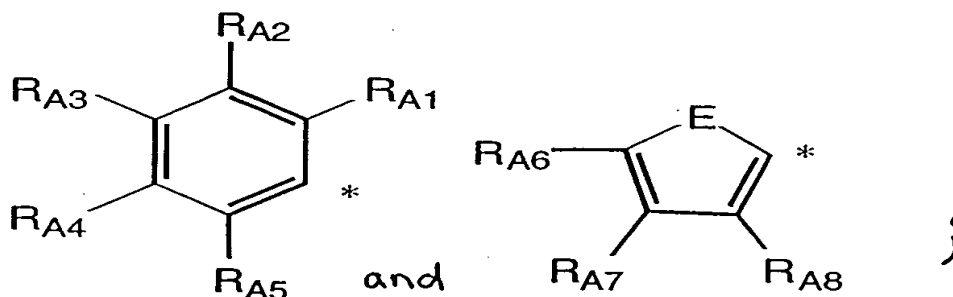
wherein A is selected from the group consisting of:

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$$\text{NC} \diagdown\!\!\!\diagup^* , \quad \text{R}_d\text{O}_2\text{C} \diagdown\!\!\!\diagup^* , \quad \text{R}_e\text{O}_2\text{C} \diagdown\!\!\!\diagup^* , \quad \text{F}_3\text{C} \diagdown\!\!\!\diagup^* , \quad \underset{\text{R}_i}{\overset{\overset{\displaystyle O}{\overset{\displaystyle \|}{\text{R}_h\text{C}}}}{\diagdown\!\!\!\diagup}}{}^* , \text{and} \quad \text{O}_2\text{N} \diagdown\!\!\!\diagup^* ;$$

$$\text{NC}\diagup \qquad \diagup\text{NC} \qquad \text{R}_f\text{O}_2\text{C}\diagup \qquad \diagup\text{R}_g \qquad \qquad \diagup\text{R}_k$$

wherein R_a, R_b, and R_c are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; and an aryl group;

As cut.

wherein R_d, R_e, R_f, R_l, R_m, R_n, R_o, R_p, R_q, R_r, R_s, R_t, R_u, R_v, R_w, and R_x are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic hydrocarbon group that is saturated or unsaturated; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; and an aryl group;

wherein R_g, R_h, R_i, and R_k are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic hydrocarbon group that is saturated or unsaturated; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; an aryl group; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; $-CO_2R_d$; and $-COR_d$;

wherein each aryl group is optionally independently selected from the group consisting of

and

wherein R_{A1}, R_{A2}, R_{A3}, R_{A4}, R_{A5}, R_{A6}, R_{A7}, and R_{A8} are the same or different and are each independently selected from the group consisting of H, a linear alkyl group, a branched alkyl group, and a cyclic alkyl group;

wherein E is selected from the group consisting of S, O, and NR_s;

wherein the alkyl group is optionally substituted or unsubstituted and optionally includes up to 25 carbon atoms;

wherein α is an integer that is greater than or equal to 0 and less than or equal to 25;

wherein β is an integer that is greater than or equal to 0 and less than or equal to 25; and

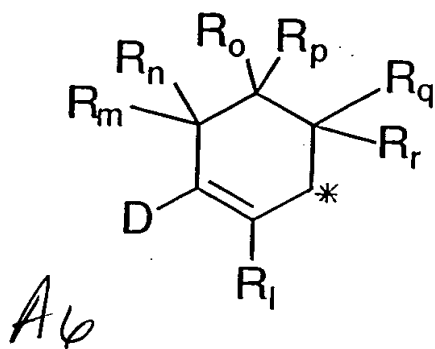wherein γ is an integer that is greater than or equal to 0 and less than or equal to 25.

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Claim 15. (amended once) A method for tuning birefringence of a liquid-crystal mixture, the method comprising adding to the liquid-crystal mixture a compound having a formula A:
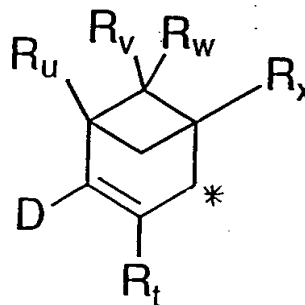
$$X \!=\! A$$
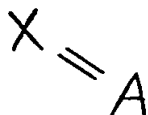
(formula A)

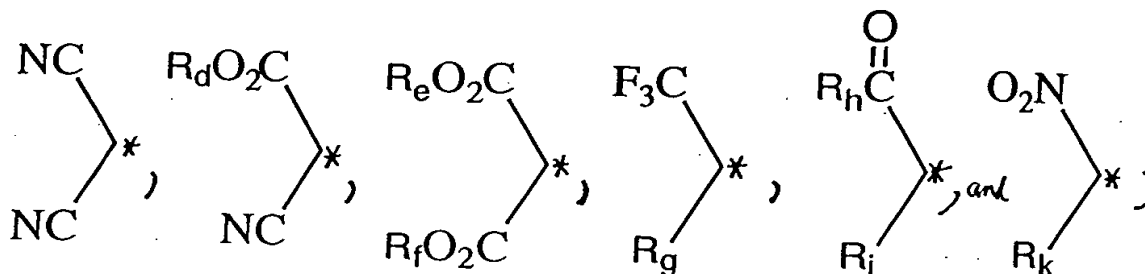wherein X is selected from the group consisting of

and

wherein D is selected from the group consisting of NR_aR_b, OR_a, SR_a, PR_aR_b, and R_c;
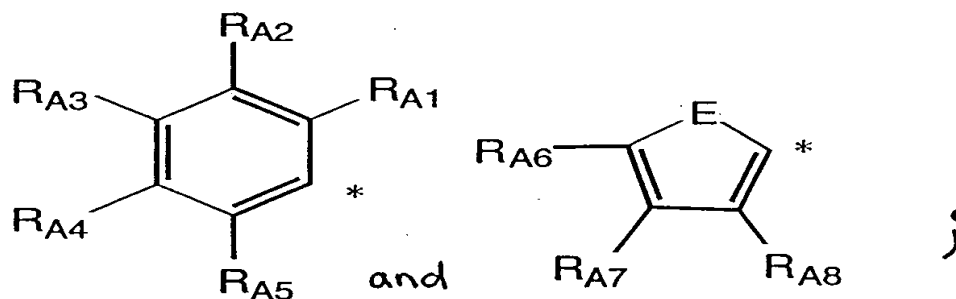
wherein A is selected from the group consisting of:

15

$$NC \underset{NC}{\overset{}{>}}\!\!\ast, \quad R_dO_2C \underset{NC}{\overset{}{>}}\!\!\ast, \quad R_eO_2C \underset{R_fO_2C}{\overset{}{>}}\!\!\ast, \quad F_3C \underset{R_g}{\overset{}{>}}\!\!\ast, \quad \overset{O}{\underset{R_i}{\overset{\parallel}{R_hC}}}\!\!\ast, \text{ and } O_2N \underset{R_k}{\overset{}{>}}\!\!\ast;$$

wherein R_a, R_b, and R_c are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; and an aryl group;

wherein R_d, R_e, R_f, R_l, R_m, R_n, R_o, R_p, R_q, R_r, R_s, R_t, R_u, R_v, R_w, and R_x are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic hydrocarbon group that is saturated or unsaturated; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; and an aryl group;

wherein R_g, R_h, R_i, and R_k are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic hydrocarbon group that is saturated or unsaturated; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; an aryl group; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; $-CO_2R_d$; and $-COR_d$;

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wherein each aryl group is optionally independently selected from the group consisting of

wherein R_{A1}, R_{A2}, R_{A3}, R_{A4}, R_{A5}, R_{A6}, R_{A7}, and R_{A8} are the same or different and are each independently selected from the group consisting of H, a linear alkyl group, a branched alkyl group, and a cyclic alkyl group;

A6
Cont.

wherein E is selected from the group consisting of S, O, and NR_s;

wherein the alkyl group is optionally substituted or unsubstituted and optionally includes up to 25 carbon atoms;

wherein α is an integer that is greater than or equal to 0 and less than or equal to 25;

wherein β is an integer that is greater than or equal to 0 and less than or equal to 25; and

$A6$
$conf.$ wherein γ is an integer that is greater than or equal to 0 and less than or equal to 25.

$A7$ Claim 17.   (amended once)   A method for increasing a $\partial n/\partial T$ of a liquid-crystal mixture, the method comprising adding a compound to the liquid-crystal mixture to yield a resulting mixture; wherein the resulting mixture at about 20-30°C has a $\partial n/\partial T$ larger than about 0.005, wherein n is a
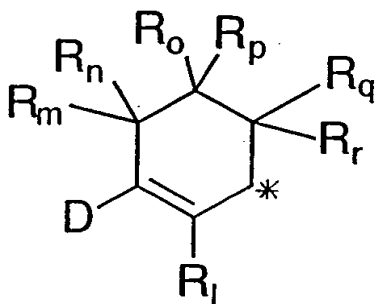
refractive index of the resulting mixture and T is a temperature
of the resulting mixture in °C; and wherein the compound has a
formula A:

$$X = A$$

(formula A)

wherein X is selected from the group consisting of

and

j

A_1

cont.

wherein D is selected from the group consisting of NR_aR_b, OR_a, SR_a,

PR_aR_b, and R_c;

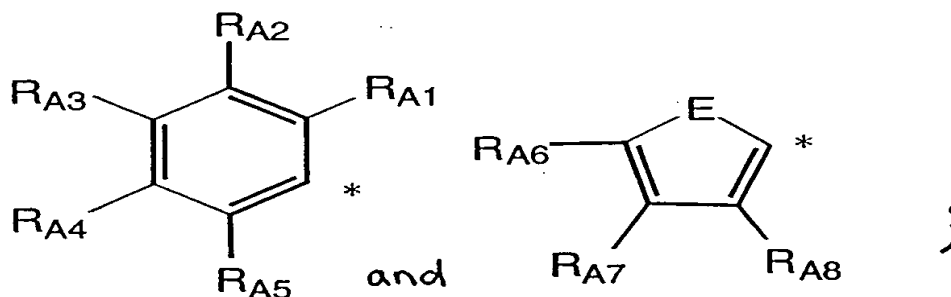wherein A is selected from the group consisting of:

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$$\underset{NC}{\overset{NC}{\diagdown}}\!\!\diagup\!\!*\,, \quad \underset{NC}{\overset{R_dO_2C}{\diagdown}}\!\!\diagup\!\!*\,, \quad \underset{R_fO_2C}{\overset{R_eO_2C}{\diagdown}}\!\!\diagup\!\!*\,, \quad \underset{R_g}{\overset{F_3C}{\diagdown}}\!\!\diagup\!\!*\,, \quad \underset{R_i}{\overset{R_hC}{\diagdown}}\!\!\diagup\!\!*\,, \text{ and } \underset{R_k}{\overset{O_2N}{\diagdown}}\!\!\diagup\!\!*\,;$$

wherein R_a, R_b, and R_c are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; and an aryl group;
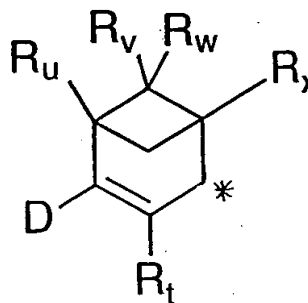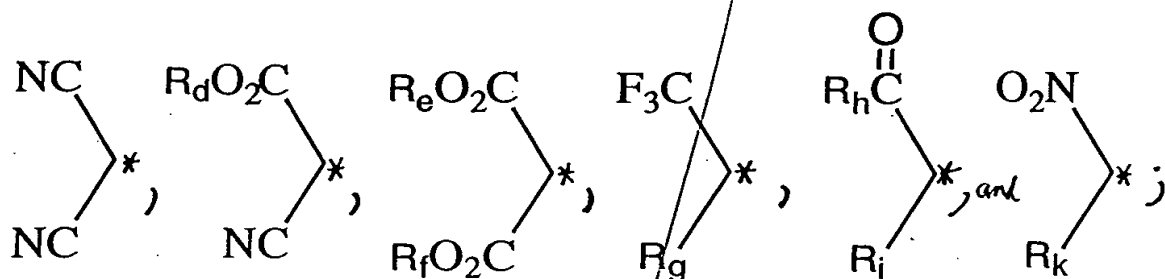
wherein R_d, R_e, R_f, R_l, R_m, R_n, R_o, R_p, R_q, R_r, R_s, R_t, R_u, R_v, R_w, and R_x are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic hydrocarbon group that is saturated or unsaturated; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; and an aryl group;

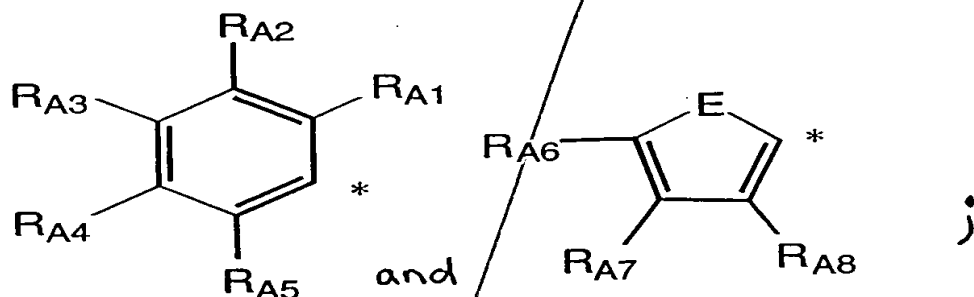wherein R_g, R_h, R_i, and R_k are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic hydrocarbon group that is saturated or unsaturated; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; an aryl group; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; $-CO_2R_d$; and $-COR_d$;

wherein each aryl group is optionally independently selected from the group consisting of

wherein R_{A1}, R_{A2}, R_{A3}, R_{A4}, R_{A5}, R_{A6}, R_{A7}, and R_{A8} are the same or different and are each independently selected from the group consisting of H, a linear alkyl group, a branched alkyl group, and a cyclic alkyl group;

wherein E is selected from the group consisting of S, O, and NR_s;

A7 cont. wherein the alkyl group is optionally substituted or unsubstituted and optionally includes up to 25 carbon atoms;

wherein α is an integer that is greater than or equal to 0 and less than or equal to 25;

wherein β is an integer that is greater than or equal to 0 and less than or equal to 25; and

wherein γ is an integer that is greater than or equal to 0 and less than or equal to 25.

Claim 19. (amended once) A compound having a formula A:

$$X = A$$

(formula A)

wherein X is selected from the group consisting of

and

j

wherein D is selected from the group consisting of NR_aR_b, OR_a, SR_a, PR_aR_b, and R_c;

wherein A is selected from the group consisting of:

22

NC—⟩—* RdO₂C—⟩—* ReO₂C—⟩—* F₃C—⟩—* RhC(=O)—⟩—*, O₂N—⟩—*;
NC   NC   RfO₂C   Rg   Rk
                                          Ri   and

wherein R_a, R_b, and R_c are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; and an aryl group;

wherein R_d, R_e, R_f, R_l, R_m, R_n, R_o, R_p, R_q, R_r, R_s, R_t, R_u, R_v, R_w, and R_x are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic hydrocarbon group that is saturated or unsaturated; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; and an aryl group;

wherein R_g, R_h, R_i, and R_k are the same or different and are each independently selected from the group consisting of: H; a linear, branched, or cyclic hydrocarbon group that is saturated or unsaturated; a linear, branched, or cyclic alkyl group; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{A1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{A2}R_{A3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; an aryl group; $-(CH_2)_\alpha(CF_2)_\gamma CF_3$; $-CO_2R_d$; and $-COR_d$;

23

wherein each aryl group is optionally independently selected from the group consisting of

Aγ
cont:

wherein R_{A1}, R_{A2}, R_{A3}, R_{A4}, R_{A5}, R_{A6}, R_{A7}, and R_{A8} are the same or different and are each independently selected from the group consisting of H, a linear alkyl group, a branched alkyl group, and a cyclic alkyl group;

wherein E is selected from the group consisting of S, O, and NR_s;

wherein the alkyl group is optionally substituted or unsubstituted and optionally includes up to 25 carbon atoms;

wherein α is an integer that is greater than or equal to 0 and less than or equal to 25;

wherein β is an integer that is greater than or equal to 0 and less than or equal to 25;

24

wherein γ is an integer that is greater than or equal to 0 and less than or equal to 25.

wherein when D is NR_aR_b, then α is greater than or equal to 1 and less than or equal to 25;

wherein when R_1, R_m, R_n, R_q, and R_r are each H, and R_o, R_p, and D are each $-CH_3$, A is not $C(CN)(CN)$;

wherein when R_1, R_m, R_n, R_o, and R_p are each H, and R_q, R_r, and D are each $-CH_3$, A is not $C(CN)(CN)$;

wherein when R_1, R_o, R_p, R_q, and R_r are each H, and R_n, R_m, and D are each $-CH_3$, A is not $C(CN)(CN)$; and

wherein when R_1, R_m, R_n, R_o, R_p, R_q, and R_r are each H, and D is $-CH_3$, A is not $C(CN)(CN)$.

APPENDIX C

Re: U.S. Patent Application No. 09/285,937
Our Ref.:   616758-3/JP

Please add the following new claims.

--21.   A composition as claimed in Claim 9, wherein R_1, R_m, R_n, R_o, R_p, R_q, R_r, R_t, R_u, R_v, R_w, and R_x are each H; wherein A is C(CN)(CN); and wherein D is R_y or OR_y, and wherein R_y is selected from the group consisting of the linear alkyl group, the branched alkyl group, the cyclic alkyl group, and the aryl group.
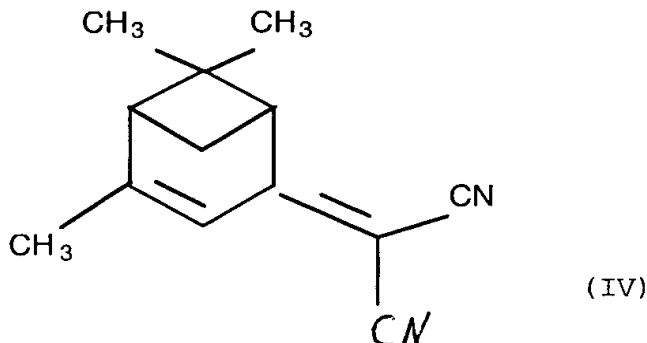
22.   A composition as claimed in Claim 9, wherein the compound is selected from the group consisting of

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(III) , and

(IV)

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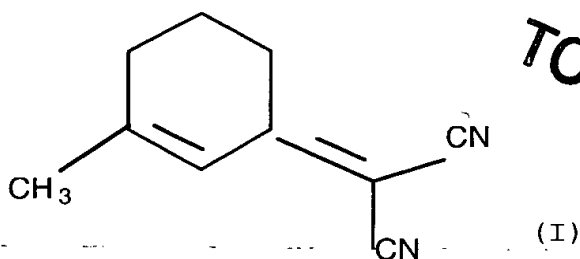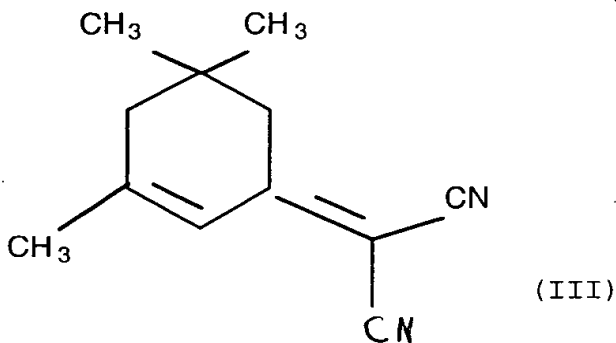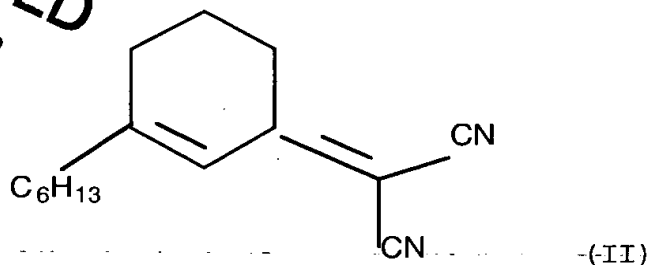
23.   A composition as claimed in Claim 9,   wherein when D is NR_aR_b, then α is greater than or equal to 1 and less than or equal to 25;

wherein when R_1, R_m, R_n, R_q, and R_r are each H, and R_o, R_p, and D are each $-CH_3$, A is not C(CN)(CN);

wherein when R_1, R_m, R_n, R_o, and R_p are each H, and R_q, R_r, and D are each $-CH_3$, A is not C(CN)(CN);

wherein when R_1, R_o, R_p, R_q, and R_r are each H, and R_n, R_m, and D are each $-CH_3$, A is not C(CN)(CN); and

wherein when R_1, R_m, R_n, R_o, R_p, R_q, and R_r are each H, and D is $-CH_3$, A is not C(CN)(CN).

24.   A composition as claimed in Claim 21, wherein the composition is a liquid-crystal composition.

25.   A composition as claimed in Claim 22, wherein the composition is a liquid-crystal composition.

26.   A composition as claimed in Claim 23, wherein the composition is a liquid-crystal composition.

27.   A method as claimed in Claim 11, wherein R_1, R_m, R_n, R_o, R_p, R_q, R_r, R_t, R_u, R_v, R_w, and R_x are each H; wherein A is C(CN)(CN); and wherein D is R_y or OR_y, and wherein R_y is selected from the group consisting of the linear alkyl group, the branched alkyl group, the cyclic alkyl group, and the aryl group.

28.   A method as claimed in Claim 11, wherein the compound is selected from the group consisting of
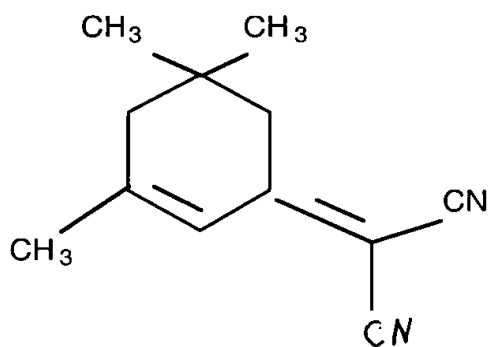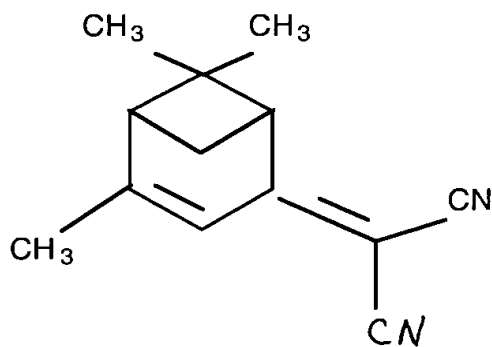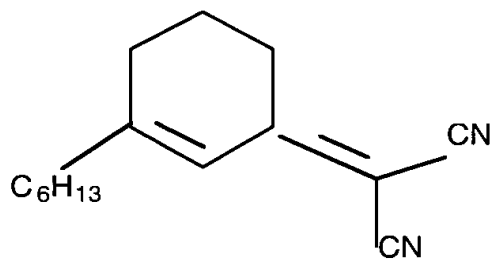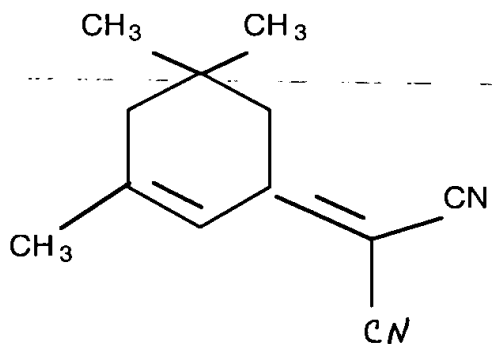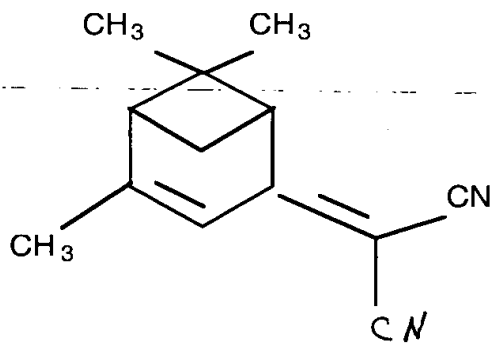
(I)

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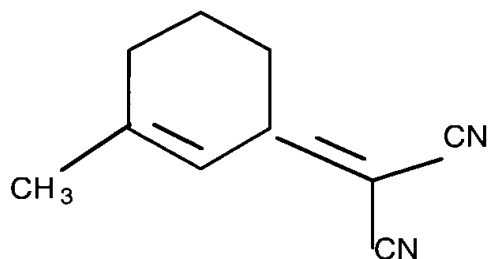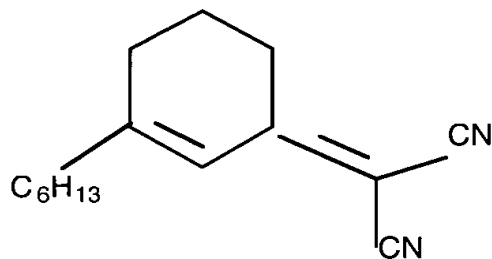
(II)

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(III) , and

(IV)

A9 cont.

29. A method as claimed in Claim 11, wherein when D is NR_aR_b, then α is greater than or equal to 1 and less than or equal to 25;

wherein when R_1, R_m, R_n, R_q, and R_r are each H, and R_o, R_p, and D are each $-CH_3$, A is not $C(CN)(CN)$;

wherein when R_1, R_m, R_n, R_o, and R_p are each H, and R_q, R_r, and D are each $-CH_3$, A is not $C(CN)(CN)$;

wherein when R_1, R_o, R_p, R_q, and R_r are each H, and R_n, R_m, and D are each $-CH_3$, A is not $C(CN)(CN)$; and

3

wherein when R_l, R_m, R_n, R_o, R_p, R_q, and R_r are each H, and D is $-CH_3$, A is not C(CN)(CN).

30. A method as claimed in Claim 13, wherein R_l, R_m, R_n, R_o, R_p, R_q, R_r, R_t, R_u, R_v, R_w, and R_x are each H; wherein A is C(CN)(CN); and wherein D is R_y or OR_y, and wherein R_y is selected from the group consisting of the linear alkyl group, the branched alkyl group, the cyclic alkyl group, and the aryl group.

31. A method as claimed in Claim 13, wherein the compound is selected from the group consisting of

A9 cont.

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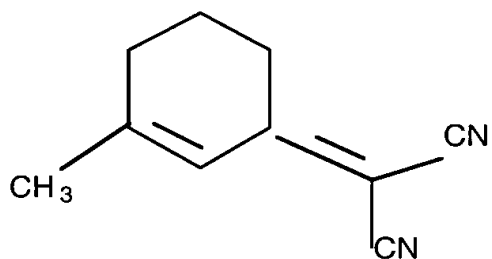
32.   A method as claimed in Claim 13,   wherein when D is NR_aR_b, then α is greater than or equal to 1 and less than or equal to 25;

wherein when R_1, R_m, R_n, R_q, and R_r are each H, and R_o, R_p, and D are each $-CH_3$, A is not C(CN)(CN);

wherein when R_1, R_m, R_n, R_o, and R_p are each H, and R_q, R_r, and D are each $-CH_3$, A is not C(CN)(CN);

wherein when R_1, R_o, R_p, R_q, and R_r are each H, and R_n, R_m, and D are each $-CH_3$, A is not C(CN)(CN); and

wherein when R_1, R_m, R_n, R_o, R_p, R_q, and R_r are each H, and D is $-CH_3$, A is not C(CN)(CN).

*A9
Cont*·   33.   A method as claimed in Claim 15, wherein R_1, R_m, R_n, R_o, R_p, R_q, R_r, R_t, R_u, R_v, R_w, and R_x are each H; wherein A is C(CN)(CN); and wherein D is R_y or OR_y, and wherein R_y is selected from the group consisting of the linear alkyl group, the branched alkyl group, the cyclic alkyl group, and the aryl group.

34.   A method as claimed in Claim 15, wherein the compound is selected from the group consisting of
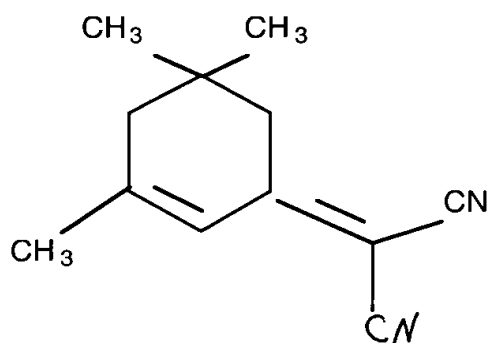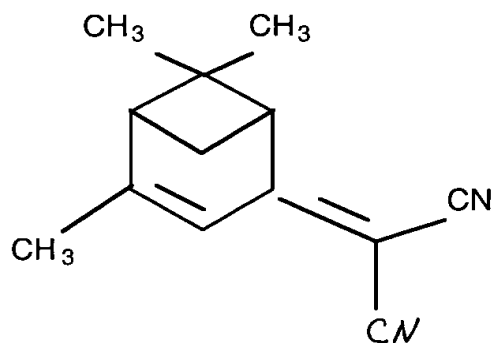
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(I)
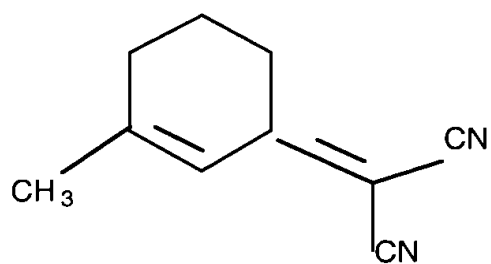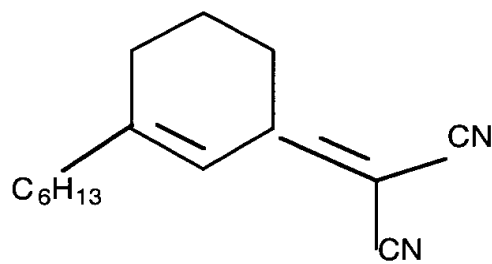
(II)

(III), and

(IV)

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cont.

35. A method as claimed in Claim 15, wherein when D is NR_aR_b, then α is greater than or equal to 1 and less than or equal to 25;

wherein when R_1, R_m, R_n, R_q, and R_r are each H, and R_o, R_p, and D are each $-CH_3$, A is not C(CN)(CN);

wherein when R_1, R_m, R_n, R_o, and R_p are each H, and R_q, R_r, and D are each $-CH_3$, A is not C(CN)(CN);

wherein when R_1, R_o, R_p, R_q, and R_r are each H, and R_n, R_m, and D are each $-CH_3$, A is not C(CN)(CN); and
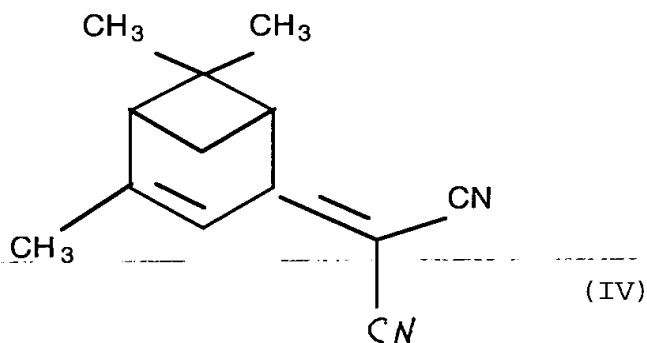
wherein when R_1, R_m, R_n, R_o, R_p, R_q, and R_r are each H, and D is $-CH_3$, A is not C(CN)(CN).

36. A method as claimed in Claim 17, wherein R_l, R_m, R_n, R_o, R_p, R_q, R_r, R_t, R_u, R_v, R_w, and R_x are each H; wherein A is C(CN)(CN); and wherein D is R_y or OR_y, and wherein R_y is selected from the group consisting of the linear alkyl group, the branched alkyl group, the cyclic alkyl group, and the aryl group.

37. A method as claimed in Claim 17, wherein the compound is selected from the group consisting of

$A9$
$cont.$

CH_3 (I) ,

C_6H_{13} (II) ,

CH_3 CH_3 CH_3 (III) , and

CH_3 CH_3 CH_3 (IV) .
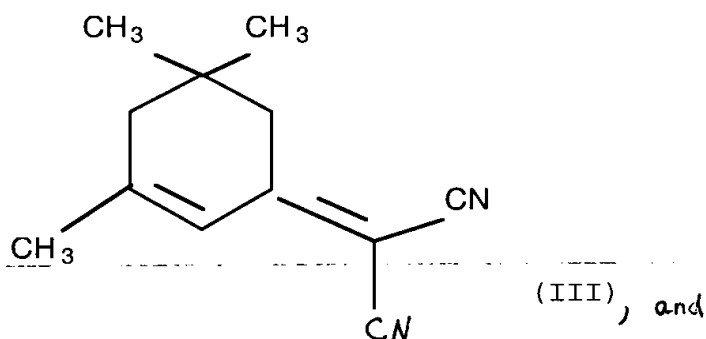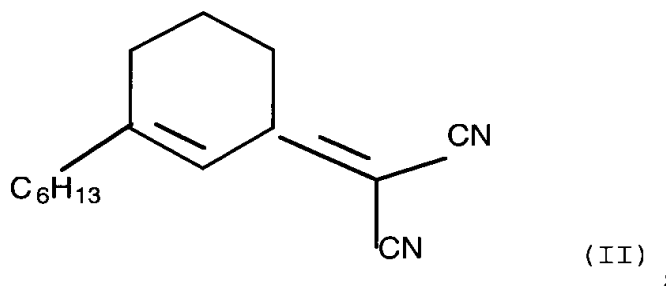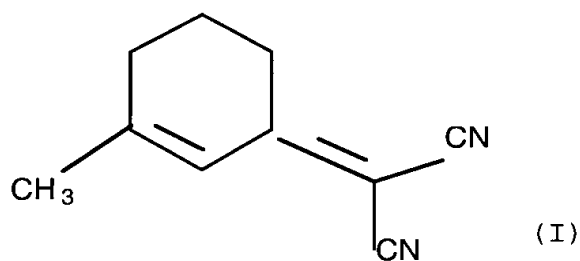
38. A method as claimed in Claim 17, wherein when D is NR_aR_b, then α is greater than or equal to 1 and less than or equal to 25;

wherein when R_1, R_m, R_n, R_q, and R_r are each H, and R_o, R_p, and D are each $-CH_3$, A is not $C(CN)(CN)$;

wherein when R_1, R_m, R_n, R_o, and R_p are each H, and R_q, R_r, and D are each $-CH_3$, A is not $C(CN)(CN)$;

wherein when R_1, R_o, R_p, R_q, and R_r are each H, and R_n, R_m, and D are each $-CH_3$, A is not $C(CN)(CN)$; and

wherein when R_1, R_m, R_n, R_o, R_p, R_q, and R_r are each H, and D is $-CH_3$, A is not $C(CN)(CN)$.--

A9
cont.